Cancer Association of South Africa (CANSA)

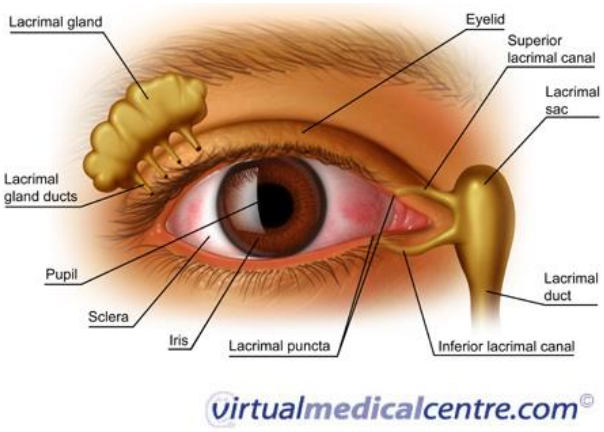
Research • Educate • Support

Fact Sheet on Cancer of the Eye

Introduction

The human eye is an organ which reacts to light for several purposes. As a conscious sense organ, the mammalian eye allows vision. Rod and cone cells in the retina allow conscious light perception and vision including colour differentiation and the perception of depth. The human eye can distinguish about 10 million colours

[Picture Credit: Eye 1]



Cancer of the Eye

An eye cancer is a cancer that starts in the eye. Different types of cancers can be found in the eye.

Primary intraocular cancers - are cancers that start inside the eyeball. In adults, melanoma is the most common primary intraocular cancer, followed by primary intraocular lymphoma. In children, retinoblastoma (a cancer arising from cells in the retina) is the most common primary intraocular cancer, and medulloepithelioma is the next most common (but is still very rare).

Secondary intraocular cancers - start somewhere else and then spread to the eye. These are not truly 'eye cancers', but they are actually more common than primary intraocular cancers. The most common cancers that spread to the eye are breast and lung cancers. Most often these cancers spread to the part of the eyeball called the uvea. The uvea consists of the middle layer of tissue surrounding the eye and is made up of the iris, ciliary body, and choroid.

Belabbes, S.B. & Belkhadir, K. 2019. Ocular metastasis revealing ductal carcinoma of the breast. *Pan Afr Med J.* 2019 Jan 16;32:29. doi: 10.11604/pamj.2019.32.29.16466. eCollection 2019.
"We report the case of a 56-year old female patient, with no particular past medical history, presenting at the Emergency Department with decreased visual acuity in the right eye occurred 2 weeks before. Ophthalmologic examination showed reduced visual acuity to perception of hand movements. Fundus examination showed serous retinal detachment associated with subretinal mass occupying almost the entirety of the vitreous cavity (A). B-mode scan was performed which objectified isoechoic choroidal mass (B) with vascularization on Doppler (C) without any excavation, measuring 18 mm along its longer

axis associated with serous detachment of the retina, highly suggestive of ocular metastasis. General assessment was performed and, in particular, mammography which revealed the presence of a nodule in the right breast (stage 4 according to BI-RADS Classification). Thoraco abdominopelvic and brain CT scan performed during staging evaluation showed many brain, bone and liver metastases. The diagnosis of metastatic breast cancer was made and the patient was referred to the Department of Oncology for specialist treatment. Ocular metastases are the most common intraocular tumors. Breast tumors are the main cause of choroidal metastases, justifying comprehensive assessment to highlight these intraocular tumors."

Intraocular melanoma (melanoma of the eye) - Intraocular melanoma is the most common type of cancer that develops within the eyeball in adults, but it is still fairly rare. Melanomas of the skin are much more common than intraocular melanomas.

Melanomas develop from pigment-making cells called *melanocytes*. When melanoma develops in the eyeball, it is usually in the uvea, which is why these cancers are also called *uveal melanomas*. About 9 out of 10 intraocular melanomas develop in the choroid (which is part of the uvea). Choroid cells make the same kind of pigment as melanocytes in the skin, so it is not surprising that these cells sometimes form melanomas.

Nearly all of the remaining intraocular melanomas start in the iris (also part of the uvea). These are the easiest for the patient and doctor to see because they often start in a pigmented spot on the iris that has been present for many years and then begins to grow. These melanomas usually are fairly slow growing, and they rarely spread to other parts of the body. For these reasons, people with iris melanomas generally have a good prognosis (outlook).

Intraocular melanomas are generally made up of 2 different kinds of cells:

- spindle cells: these are long, thin cells
- epithelioid cells: these cells are almost round but with some straight edges

Most tumours are composed of both kinds of cells. The outlook is better if the tumours are mostly spindle cells as opposed to mostly epithelioid cells. Epithelioid tumours are more likely to metastasize (spread) to distant sites (such as the liver). If you have intraocular melanoma, your doctor can tell you which type of cells were found.

Primary intraocular lymphoma (lymphoma of the eye) - Lymphoma is a type of cancer that starts in immune system cells called lymphocytes. It usually starts in lymph nodes, which are bean-sized collections of immune system cells scattered throughout the body. Lymphomas can also start in internal organs such as the stomach, lungs, and rarely, in the eyes.

There are 2 main types of lymphoma: Hodgkin disease and non-Hodgkin lymphoma. Primary intraocular lymphoma is always a non-Hodgkin lymphoma. Most people with primary intraocular lymphoma are elderly or have immune system problems such as the acquired immunodeficiency syndrome (AIDS). Primary intraocular lymphoma is often seen along with lymphoma of the brain, known as *primary central nervous system (CNS) lymphoma*.
Rare cancers in children - There are 2 main types of cancers of the eyeball that develop in children. These are:

- Retinoblastoma - a rare type of eye cancer that nearly always occurs in children under the age of 5
- Medulloepithelioma - a very rare type of eye tumour found most often in young children. It does not usually spread. Treatment is surgery to remove the tumour. Occasionally, this will involve removing the eye

Kaliki, S., Vasanthapuram, V.H. & Mishra, D.K. 2019.
Purpose: To describe the clinical features, treatment, and outcomes of conjunctival melanoma in Asian Indians.
Methods: Retrospective study of 42 patients.
Results: The mean age at presentation of conjunctival melanoma was 43 years (median, 45 years; range, 9-78 years). There were 20 (48%) males and 22 (52%) females. Nineteen patients (45%) had a known history of a preexisting pigmented conjunctival lesion. Bulbar conjunctiva (n = 28; 67%) was the most common tumor epicenter, and medial ocular surface quadrant (n = 15; 36%) was more commonly involved. The mean tumor basal diameter was 12 mm (median, 10 mm; range, 4-30 mm), and the mean tumor thickness was 4 mm (median, 2 mm; range, 1-30 mm). Majority of the patients had a pigmented tumor (n = 33; 79%). The tumors arose de novo (n = 17, 41%) or were associated with conjunctival nevus (n = 9; 21%) or primary acquired melanosis (n = 16, 38%). Wide excisional biopsy, adjunctive cryotherapy, and amniotic membrane grafting were performed in 27 (71%) patients, 11 (29%) underwent orbital exenteration, and 4 were lost to follow-up prior to definitive treatment. Over a mean follow-up period of 24 months (median, 9 months; range, <1 to 136 months), four (11%) patients had tumor recurrence, seven (18%) had locoregional lymph node metastasis, and four (11%) developed systemic metastasis and died due to metastatic disease.
Conclusion: Conjunctival melanoma predominantly occurs in middle-aged Asian Indians and is associated with a high rate of systemic metastasis and death.

Cancer Affecting the Retina of the Eye
Cancers affecting the retina usually occur in the choroid, a dense layer of blood vessels that supplies the retina. The choroid is sandwiched between the retina and the sclera (the outer white layer of the eye). Because the retina depends on the choroid for its support and half of its blood supply, damage to the choroid by a cancer is likely to affect vision.

Choroidal melanoma: Choroidal melanoma is a cancer that originates from the pigment-producing cells (melanocytes) of the choroid. Choroidal melanoma is the most common cancer originating in the eye. It is most common among whites. It is less common among darker-skinned people. It occurs most frequently at age 55 to 60.

In its early stages, the cancer usually does not interfere with vision. Later, it may cause blurred vision or retinal detachment, with symptoms such as flashes of light, a veil or curtain across the visual field, or a sudden increase or change in floaters (objects that appear to move through a person's field of vision). Melanomas, particularly if large, may extend into the orbit or spread through the bloodstream (metastasize) to other parts of the body and may be fatal.

Early diagnosis is important because smaller tumours are easier to cure. The diagnosis is made using an ophthalmoscope and doing tests, which may include ultrasonography, fluorescein angiography and serial photographs.

If the melanoma is small, treatment with a laser, radiation, or an implant of radioactive materials may preserve vision and save the eye. If the cancer is large, the eye may have to be removed.

Choroidal metastases: Choroidal metastases are cancers that have spread to the choroid from other parts of the body. Because of its rich blood supply, the choroid is often a place to which cancers from other parts of the body may spread. In women, breast cancer is the most common cause. In men, cancers of the lung and prostate are the most common causes.

Often, these cancers cause no symptoms until they are advanced. Symptoms, when they develop, are often loss of vision or symptoms of retinal detachment. Vision loss may be severe.

Treatment is usually with chemotherapy, radiation therapy, or both (Merck Manual).

Choroidal Melanoma

Choroidal melanoma is a cancer that affects part of the eye. It develops in the choroid, the sponge-like membrane at the back of the eye between the sclera (the white of the eye) and the retina. (The retina is the light-sensitive structure at the back of the eye. It sends visual information to the brain.) The choroid is rich in blood vessels and supplies nutrients to the retina.

Over time, many choroidal melanomas enlarge and cause the retina to detach. This can lead to vision loss. The tumours also can spread (metastasize) to other parts of the body. The liver is the most common site for metastasis. If it spreads, this cancer can be fatal.

Although choroidal melanoma is rare, it is the most common eye cancer in adults. It usually occurs in people who are middle-aged or older.

Melanomas usually occur in the skin. But they can also develop in places where certain cells contain the pigment melanin. The choroid is one such example (Intelihealth.Com).

Eye Melanoma

Melanoma is a type of cancer that develops in the cells that produce melanin — the pigment that gives the skin its colour. The eyes also have melanin-producing cells and can develop melanoma. Eye melanoma is also called ocular melanoma.

Most eye melanomas form in the part of the eye one cannot see when looking in a mirror. This makes eye melanoma difficult to detect. In addition, eye melanoma typically does not cause early signs or symptoms.

Treatment is available for eye melanomas. Treatments for some small eye melanomas may not interfere with vision. However, treatment for large eye melanomas typically causes some vision loss. Eye melanoma may not cause signs and symptoms. When they do occur, signs and symptoms of eye melanoma can include:

- a growing dark spot on the iris
- a sensation of flashing lights
- a change in the shape of the dark circle (pupil) at the centre of your eye

- poor or blurry vision in one eye
- loss of peripheral vision
- sensation of flashes and specs of dust in your vision (floaters)

Lacrimal Gland Tumour

The lacrimal glands are the glands that secrete tears and are located above and to the side of the eye. When lacrimal gland cells become abnormal and multiply, they form a growth of tissue called a tumour. A lacrimal gland tumour can be benign (noncancerous) or malignant (cancerous, meaning it can spread to other parts of the body). There are four major types of lacrimal gland tumours:

Benign mixed epithelial tumour - A benign mixed epithelial tumour is a noncancerous tumour that does not spread to other parts of the body but will continue to grow if not treated. This type of tumour begins in the cells that line the lacrimal gland.

Malignant mixed epithelial tumour - A malignant mixed epithelial tumour also begins in the cells that line the lacrimal gland. If it is not treated, it will spread to other parts of the body.

Lymphoma - Lymphoma can involve various structures of the eye, however, the conjunctiva (the mucous membrane lining the inner surfaces of the eyelids and the outer surface of the white of the eye) and lacrimal glands are the most common. Most ocular (eye-related) lymphoma is non-Hodgkin lymphoma, and may be associated with systemic (whole body) or central nervous system (brain and spinal cord) lymphoma.

Adenoid cystic carcinoma (AdCC) of the lacrimal gland - AdCC is a rare form of adenocarcinoma, which is a broad term covering any cancer arising from glandular tissues. An AdCC tumour is characterized by a distinctive pattern, in which bundles of epithelial cells surround and/or infiltrate ducts or glandular structures within the organ. When an AdCC tumour of the lacrimal gland grows, it commonly pushes the eye forward and causes it to bulge, a condition called proptosis. Another characteristic is pain, due to local nerves being invaded by the tumour (Cancer.Net).

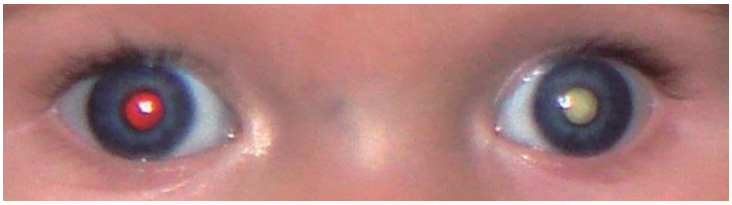
Retinoblastoma in Children

Retinoblastoma is a rare type of eye cancer which mainly affects children under 5 years of age. Around 98% of children are successfully treated.

The signs of retinoblastoma, such as a white reflection in the eye or white pupil, or a squint, as described below, can also be caused by other less severe conditions and can sometimes be a complete false alarm and not be anything at all. Although this may be the case it is always best to have a child's eyes checked just to rule out any serious illness.

The most important thing to do if you see any of the symptoms is to get the child's eyes examined quickly.

The signs to look out for



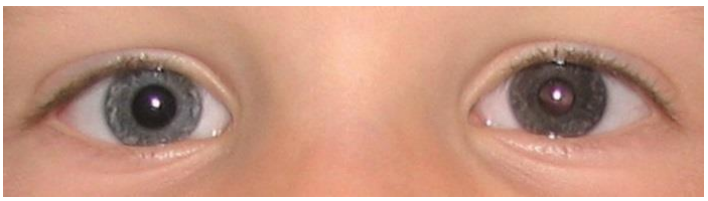
A white reflex: A white eye, white pupil or white reflection can be seen in a photograph where the flash has been used. Often one eye will have "red eye" which is normal but the other eye may look white, yellow or orange. This may be seen in just one or many photographs of the child. A white 'reflex' or white eye/pupil may also be seen when the child is in artificial light or a darkish room. Some parents say that it looks like a cat's eye caught in light or that they think they can see the back of their child's eye, other parents say it looks like jelly. This white reflex may only be seen every so often but in some cases it is present all the time.

An absence of 'red eye' in flash photographs: In a photograph where one eye has 'red eye' (which is normal) the other eye may look black or looks 'wrong'. This can also be a sign that something is not right.

A squint: A squint can be a sign of retinoblastoma, although a squint can also be nothing more than a squint. It is always worth having it checked out quickly just to make sure. Some people call a squint a "lazy eye"; it is where one or both eyes look in or out.

Red, sore or swollen eye without infection: A child's eye may become very red and inflamed for no reason. This sign is usually linked with other signs.

A change in colour to the iris: The iris, the coloured part of the eye, can sometimes change colour in one eye, sometimes only in one area.



Deterioration in vision: A child may have deterioration in their vision or they may have had poor vision from birth. You may notice that your child does not focus or fix & follow as well as other children or babies of the same age.

If one or more of the above signs are noticed ***always*** take the child to have his/her eyes examined. (Retinoblastoma Childhood Eye Cancer Trust – including picture credits).

Ortiz, M.V. & Dunkel, I.J. 2016.
"Retinoblastoma is the most common primary intraocular malignancy of childhood. It typically presents with leukocoria or strabismus. In later stages of the disease, the child may exhibit proptosis, buphthalmos, or hypopyon. The pathognomonic molecular aberration is a loss of function mutation in the RB1 gene on chromosome 13q. The degree of tumor involvement within the eye is defined by its group. Grouping was historically done with Reese-Ellsworth System. Recent therapeutic advances have led to the development of a new grouping system, the International Classification of Retinoblastoma (ICRB). In cases of extraocular extension and metastatic disease, the degree of tumor involvement outside of the eye is defined by its stage. Retinoblastoma is staged using the International Retinoblastoma Staging System (IRSS). Children with intraocular retinoblastoma have an excellent overall and ocular survival. In order to avoid the morbidity of enucleation and external beam radiation, treatments for isolated intraocular retinoblastoma have progressively moved toward targeted local modalities. Patients with extraocular involvement, such as those with trilateral retinoblastoma, have a poorer prognosis. The majority of these higher stage patients are now able to be cured with combination chemotherapy."

Medulloepithelioma in Children
Medulloepithelioma is uncommon. Its precise incidence is also unknown. Based on relative prevalence data from multiple clinical and pathological case series, however, its incidence can be estimated at approximately one thirtieth to one fiftieth that of retinoblastoma. This would correspond to a cumulative lifetime incidence of approximately 1 case per 450 000 to 1 000 000 persons.

Intraocular medulloepithelioma is usually a congenital or infantile tumor, although juvenile- and even adult-onset cases have been reported. The average age of the affected individual at diagnosis is about 5 years in most series. Medulloepithelioma affects all ethnic groups and both sexes equally. It does not appear to be transmitted genetically. No known risk factors exist for this tumour.

<u>Ocular Manifestations</u>
The usual presenting symptoms of medulloepithelioma are a red eye, change in colour of the iris, visible mass in the iris, and (in adults and some older children) visual impairment. Medulloepithelioma of the ciliary body typically appears as a tan to white lesion of the extreme peripheral fundus. Because of its peripheral location, the tumour may be detectable
only by binocular indirect ophthalmoscopy under anesthesia. A tumour of this type frequently appears intrinsically cystic or has prominent neuroepithelial cysts on its surface. In occasional patients, localised absence of the zonule and resultant abnormalities of lens curvature (lens coloboma), lens subluxation, and cataract have been observed.

Galluzzi, P., Casseri, T., Cerase, A., Gguglielmucci, D., Toti, P. & Hadjistiljanou, T. 2018.
PURPOSE: To describe the neuroradiological features of intraocular medulloepithelioma.
METHODS: We retrospectively analyzed the clinical, histopathological, and MRI data of five children with medulloepithelioma. In addition to conventional images, DWI was performed in four patients and mean ADC was calculated; this was limited to the technique of this cohort of

patients. DCE was performed in all patients. This is the first paper that presents diffusion and perfusion characteristics of medulloepithelioma.
RESULTS: Four tumors were malignant teratoid variants, two non-teratoid variants. Tumors were hyperintense on T1-weighted images and hypointense on T2-weighted images. Calcifications were detectable in two out of five tumors. Cavities were detectable in three out of five tumors. All tumors showed some degree of enhancement. The mean ADC of all four patients was $1.156 \pm 242.75 \times 10^{-3}$ mm^2/s. Mean ktrans, Ve, Kep, TME, AUC, SER, and peak enhancement were 0.082 ± 0.054, 0.19 ± 0.076, 0.31 ± 0.084, 0.97 ± 0.0784, 1.22 ± 0.81, 67.34 ± 31.7, and 14.84 ± 7.34 respectively. TICs showed a very high ratio of slow increase, > 50% persistence and some degree of wash out. Teratoid variants showed higher K-trans, AUC, VE, TME, and persistent TIC pattern than non-teratoid ones, while plateau pattern ratio was lower.
CONCLUSION: Conventional MR findings were similar to previously reported cases. Mean ADCs were moderately high. TICs showed slow increase and presence of wash out. K-trans, AUC, VE, and TME were higher in teratoid variants. Permeability parameters in differential diagnosis with lesions mimicking medulloepithelioma need further investigations.

Incidence of Cancer of the Eye in South Africa
According to the outdated National Cancer Registry (2016), known for under reporting, the following number of eye cancer cases was histologically diagnosed in South Africa during 2016:

Group - Males 2016	Actual No of Cases	Estimated Lifetime Risk	Percentage of All Cancers
All males	271	1:1 064	0,69%
Asian males	2	1:4 556	0,20%
Black males	244	1:857	1,87%
Coloured males	8	1:4 515	0,17%
White males	17	1:2 090	0,06%

Group - Females 2016	Actual No of Cases	Estimated Lifetime Risk	Percentage of All Cancers
All females	295	1:1 189	0,70%
Asian females	3	1:3 211	0,24%
Black females	271	1:1 016	1,34%
Coloured females	6	1:5 556	0,11%
White females	14	1:1 977	0,09%

The frequency of histologically diagnosed cases of cancer of the eye in South Africa for 2016 was as follows (National Cancer Registry, 2016):

Group - Males 2016	0 – 19 Years	20 – 29 Years	30 – 39 Years	40 – 49 Years	50 – 59 Years	60 – 69 Years	70 – 79 Years	80+ Years
All males	25	12	71	90	45	21	4	3
Asian males	2	0	0	0	0	0	0	0
Black males	21	11	68	83	40	17	3	0
Coloured males	1	1	1	2	2	0	0	1
White males	1	0	2	5	2	4	1	2

Group - Females 2016	0 – 19 Years	20 – 29 Years	30 – 39 Years	40 – 49 Years	50 – 59 Years	60 – 69 Years	70 – 79 Years	80+ Years
All females	30	26	102	83	53	31	15	4
Asian females	1	0	0	1	1	0	0	0
Black females	26	26	98	74	28	13	3	4
Coloured females	1	0	2	2	1	0	0	0
White females	2	0	2	5	2	3	1	1

N.B. In the event that the totals in any of the above tables do not tally, this may be the result of uncertainties as to the age, race or sex of the individual. The totals for 'all males' and 'all females', however, always reflect the correct totals.

Risk Factors for Cancer of the Eye

The following risk factors were identified:

Risk factors for primary intraocular melanoma

Race/ethnicity - the risk of intraocular melanoma is much higher in whites than in African Americans or Asian Americans

Eye colour - People with light coloured eyes have an increased risk of intraocular melanoma. People with blue eyes are somewhat more likely to develop melanoma of the eye than are people with brown eyes

Certain inherited conditions – The following inherited conditions are of importance:

- *dysplastic nevus syndrome:* in which people have abnormal moles of the skin and an increased risk of skin melanoma, may also increase the risk for developing melanoma of the eye
- people with abnormal brown spots on the uvea (known as *oculodermal melanocytosis* or *nevus of Ota*) also have an increased risk of developing eye melanoma
- eye melanomas can run in some families who do not have these conditions, but this is very rare

Sun exposure - Although too much exposure to sunlight (or sunlamps) has been proposed as a possible risk factor for melanoma of the eye, it has never been proven

Certain occupations - Some studies have suggested that welders, farmers, fishermen, chemical workers, and laundry workers may have a higher risk of eye melanoma, but none of these links has been proven conclusively

Risk factors for primary intraocular lymphoma

The only known risk factor for primary lymphoma of the eye is having a weakened immune system. Examples include patients with the acquired immunodeficiency syndrome (AIDS) as well as people who take anti-rejection drugs after organ or tissue transplants.
(Medline Plus).

Signs and Symptoms of Eye Cancer

Many patients with eye melanoma don't have symptoms unless the cancer grows in certain parts of the eye or becomes more advanced. Signs and symptoms of eye melanomas can include:

- problems with vision (blurry vision or sudden loss of vision)
- floaters (spots or squiggles drifting in the field of vision) or flashes of light
- visual field loss (losing part of your field of sight)
- a growing dark spot on the iris
- change in the size or shape of the pupil
- change in position of the eyeball within its socket
- bulging of the eye
- change in the way the eye moves within the socket
- pain is rare except in cases of massive spread outside the eye. In such cases, bulging or a change in the position of the eye may also be noted

Other, less serious conditions can also cause many of these symptoms. For example, floaters may occur as a normal part of the aging process. Still, if any of these symptoms are experienced, it is important to see a doctor right away so the cause can be found and treated, if needed.

Diagnosis of Eye Cancer
Leading-edge diagnostic tools and methods for diagnosing eye cancer include:

- sentinel lymph node biopsy to detect early microscopic metastasis
- ultrasound biomicroscopy to diagnose intraocular tumours
- confocal biomicroscopy
- optical coherence tomography (OCT) for more accurate diagnosis of conjunctival cancers

<u>Other Eye Cancer Diagnostic Tests</u>
In addition to damaging vision, eye tumours can spread to the optic nerve, the brain and the rest of the body. Therefore, early diagnosis and treatment are extremely important. Melanoma tends to spread via blood vessels to distant organs.

Usually an examination by an ophthalmologist or other eye care provider can diagnose ocular cancer. Tests may include:

- dilated retinal exam to help diagnose intraocular tumours
- ultrasound of the eye for intraocular tumours
- careful inspection of the outside of the eye and eye movements for orbital, eyelid and conjunctival tumours
- imaging tests, such as:
    - CT or CAT (computed axial tomography) scans
    - MRI (magnetic resonance imaging) scans
    - surgical biopsy to confirm cancers of the orbit, eyelid or conjunctiva

Examination of the Eye

Examination of the eye by an ophthalmologist (a medical doctor specialising in diseases of the eye) is often the most important step in diagnosing melanoma of the eye. The doctor will ask about any symptoms and check vision and eye movement. The doctor will also look for enlarged blood vessels on the outside of the eye, which can be a sign of a tumour inside the eye.

The ophthalmologist may also use special instruments to get a good look inside the eye for a tumour or other abnormality. Drops may be put in the eye to dilate the pupil before the doctor uses these instruments.

- An ophthalmoscope (also known as a *direct ophthalmoscope*) is a hand-held instrument consisting of a light and a small magnifying lens.

[Picture Credit: Ophthalmoscope]

- An indirect ophthalmoscope and a slit lamp is more like a large microscope. For this exam, the patient sits down and rests his/her chin on a small platform, while the doctor looks into his/her eye through magnified lenses. This examination can often provide a more detailed view of the inside of the eye than the direct ophthalmoscope.

[Picture Credit: Indirect Ophthalmoscope]

- A gonioscopy lens is a specially mirrored lens that is placed on the cornea (after it is numbed). This lets the doctor see the deep structures in the angle of the front of the eye near the iris. It can provide information on tumour growth into areas of the eye that would otherwise be hard to see.

[Picture Credit: Gonioscopy lens]

Most of the time, an eye examination alone can make the diagnosis. In some cases, imaging tests such as ultrasound may be required to confirm the diagnosis. Very rarely a biopsy will also be needed.

Many people have a benign tumour in the eye called a *choroidal nevus*, which can sometimes be mistaken for an eye melanoma. A small number of these will eventually turn into melanomas. If the ophthalmologist spots one of these, he or she will likely advise regular eye exams to see if it grows.

If symptoms and/or the results of the eye exam suggest eye cancer, more involved tests will likely be done. These might include imaging tests or other procedures.

Ultrasound scan - an ultrasound of the eye is usually done. A local anaesthetic will be put on to the surface of the eye. Then the doctor will move a small probe over the eye's surface to help find out

more about the tumour, including its size. This might be a little uncomfortable, but should not be painful.

Angiogram - The doctor may take pictures of a suspected cancer with a special camera. This test is called a fluorescein angiogram. This means looking at blood vessels using a type of dye. The patient is given an injection of dye (called fluorescein) into the arm. The dye travels through the bloodstream to the blood vessels of the eye. The camera shows up the dye on photographs, which helps the doctor to find out more about the nature of any possible tumour.

Testing genetic information in the cells - If there is an ocular melanoma the surgeon may ask a pathologist to examine the biopsy sample or tumour for abnormalities of the chromosomes in the tumour cells. This is known as cytogenetic testing and it may help to show the stage of the melanoma.

Other tests – A patient may have blood tests to check his/her general health and see how well their liver and kidneys are working. Melanoma of the eye can spread to the liver so an ultrasound scan of the liver is quite likely to check for any spread of the cancer.

Recurrent Cancer of the Eye

Recurrent cancer is cancer that has come back after treatment. It may return in the eye or in another part of the body. If there is a recurrence, the cancer may need to be staged again (called re-staging) using the system above.

Treatment of Eye Cancer

Most people with eye cancers are referred to a specialist centre for their treatment. These centres provide a range of treatments and offer the one most suitable. For some types of eye cancer there may be only one treatment that is suitable. There may be several that are possible to have. The eye surgeon will explain treatment choices in detail. They will talk through the potential benefits and complications of each before a final decision is made. It may help to get a second opinion from another eye cancer specialist.

Treatment for melanoma of the eyeball

Treatment for eye melanoma is surgery or radiotherapy or both.
Whether a patient has surgery or radiotherapy depends on:

- where the tumour is
- the size of the tumour and
- how much it is affecting sight

If the tumour is already preventing the patient from seeing out of the eye, he/she will probably have surgery to remove the eye. This operation is called an enucleation. But if the patient can still see with that eye, the doctor may try to keep the sight and decide to:

- remove just the tumour
  or
- give radiotherapy

Treatment for iris melanoma

This type of cancer can be so slow growing that one does not need treatment, especially if there are no symptoms. The doctor will give request such a patient to report for regular check-ups to make sure the cancer is not getting bigger. If the tumour is growing, or if it is causing symptoms, the patient will normally have one of the following operations to:

- removal of the iris (iridectomy)
- removal of the iris and the tissues around the clear layer covering the front of the eye (the cornea) – this operation is called an iridotrabeculectomy
- removal of the iris and the ciliary body (the muscle that focuses the eye) – this operation is called a iridocyclectomy
- removal of the whole eye (enucleation)
- for some iris melanomas the doctor may suggest radiotherapy

Treatment for choroid or ciliary body melanoma

If melanoma of the choroid or ciliary body is not getting bigger the patient may not need treatment straight away. The patient will be requested to report for regular check-ups to make sure the tumour has not started to grow.

If the patient does need treatment, for small melanomas he/she may have one of the following:

- radiotherapy
- surgery to remove just the tumour
- surgery to remove the whole eye (enucleation)
- for medium sized melanomas you may have one of the above treatments or radiotherapy, followed by surgery to remove the eye
- surgery or radiotherapy are the treatments for large melanomas. If you need surgery, this will usually mean removing the eye (enucleation).

Treatment for melanomas that have spread outside the eye

If the tumour has spread outside the eye, to the optic nerve or the eye socket, it is called an extraocular melanoma. The doctor may refer to this as 'extraocular extension'. It is a more advanced stage and the patient will probably need surgery to remove the eye. This operation is called enucleation. The patient may need further surgery to the eye socket to make sure all the cancer is gone. The patient may have radiotherapy as well.

Treatment for recurrent eye melanoma

If the cancer has come back in the eyeball (intraocular) the patient will most likely have surgery to remove the eye (enucleation). The patient may also have radiotherapy after surgery to kill off any cancer cells left behind.

If the cancer has come back outside the eyeball (extraocular melanoma) the patient may have chemotherapy or biological therapy or both. Clinical trials are looking at how helpful biological therapy may be in treating melanoma of the eye.

Treatment for lymphoma of the eye

Doctors call lymphoma of the eye intraocular lymphoma. They treat intraocular lymphoma in a similar way as other types of non-Hodgkin's lymphoma. The patient may have radiotherapy, chemotherapy or both. For some types of non-Hodgkin's lymphoma biological therapy may be used. The patient is not likely to have surgery to treat intraocular lymphoma.

Radiotherapy to treat intraocular lymphoma

To treat lymphoma of the eye the doctor may suggest the patient has external radiotherapy to the eye and brain. This can get rid of the cancer in the eye and also helps to stop it coming back in the brain or spinal cord.

Chemotherapy to treat intraocular lymphoma

Most people with lymphoma of the eye will have chemotherapy. The patient may have chemotherapy injected into the fluid around the spinal cord (intrathecal chemotherapy). The patient might have this treatment along with radiotherapy.
(Cancer Research UK).

Prognosis (Outlook)

An important thing to remember for those diagnosed with eye cancer is that every cancer case, no matter how common or rare it may be, is unique. While the tumour of one person may progress very slowly, providing plenty of time to treat the disease, the tumour of another may grow at a much faster- and far more deadly- rate. What it comes down to, essentially, is the makeup of each individual body, and that body's ability to respond to cancer treatments.

An eye cancer prognosis is generally referred to as the outlook or outcome of eye cancer. An eye cancer prognosis usually takes into account factors, such as the exact type of cancer, how long the cancer has been present, which parts of the eye are affected, the possibility that complications are likely to occur during the treatment period, and the typical rate of recovery, survival rate, and death rate.

As a basic rule, the survival rate of any cancer is far better when the cancer is found and treated in its earliest stages. While many cancers will often have a specific survival rate attached to the different stages of the cancer, the survival rate for eye cancer is predominantly based on an overall history of success, since eye cancers are so rare to begin with. For intraocular melanoma, the most common of eye cancers, the survival rate is currently set at five years. This number is based on cancers which are confined to the eye, and also on the percentage of patients who live at least five years after been diagnosed (studies show that about 84% survive at least 5 years after diagnosed, specifically).

For melanomas which are more advanced and have spread extensively to other parts of the body, however, the 5-year survival rate can drop down anywhere from 15% to 45%, depending on the stage

of the cancer. For intraocular lymphoma, which is even more rare, certain studies have shown that if lymphoma is confined to the eye and does not spread, roughly 50% of patients survive five years, or more, after being diagnosed. If the lymphoma has spread, especially to the brain, the survival rate is far lower.

A survival rate should not, by any means, turn an eye cancer prognosis in a death-sentence, though. Again, the information which supplies doctors with a survival rate is often reflective of broad, older studies, and especially if a cancer is very rare, as with eye cancer, the number may not necessarily be all that accurate in relation to a new eye cancer patient's outlook.

Other factors, such as the exact type of cancer cells which are present, also effect a cancer prognosis. Tumour cells which are long and thin are often less serious and have a better overall cancer prognosis than rounder cells, for instance. Age and overall health, as with many diseases, will also affect the successful treatment of a cancer.
(Disease.Com).

Life Changes Following a Diagnosis of Eye Cancer
The following are some of the life changes that can be expected:

- Changes in your sight after eye cancer - Eye cancers do not always cause problems with your sight. It will depend on the type of eye cancer you have. The more advanced the cancer, the more likely it is to affect your sight. Problems can range from very minor changes in your vision to complete loss of sight in one eye.

- Coping practically with sight changes - Sight changes can affect reading, driving, work, and how one gets around. If one has had an eyeball removed (enucleation) the main thing one will notice is that it is a lot harder to judge the distance between
- objects. One eventually gets used to this and adjust. It is also noticed that one cannot see so well to one side without turning one's head.

- Changes in your appearance after eye cancer - Surgery that involves the eye may change the way one looks. Modern surgical techniques and reconstructive surgery means that one is less likely to have much scarring, even with very big operations. With time, many scars will fade and be far less visible. So even though one may be aware of them, others may not notice.

- Using an artificial eye - If one has had an eye removed this means adjusting to having an artificial eye. Even if other people don't notice it, the person him/herself will still be aware of looking different. The change in appearance can be hard to get used to.

- How surgery may affect one's self-esteem - It can be difficult to accept sudden changes to one's looks. It is not unusual for people who have had surgery to their face to feel very angry, confused and upset for some time afterwards.

- Changes in your sex life with eye cancer - Any changes in one's appearance and sight may make one feel less confident about sex. If one has had an eye removed and have an artificial eye one may worry about how this looks to one's partner. If surgery has affected other parts

of one's face and one is not happy with how he/she looks, further surgery may be of help to correct this.

About Clinical Trials

Clinical trials are research studies that involve people. They are conducted under controlled conditions. Only about 10% of all drugs started in human clinical trials become an approved drug.

Clinical trials include:

- Trials to test effectiveness of new treatments
- Trials to test new ways of using current treatments
- Tests new interventions that may lower the risk of developing certain types of cancers
- Tests to find new ways of screening for cancer

The **South African National Clinical Trials Register** provides the public with updated information on clinical trials on human participants being conducted in South Africa. The Register provides information on the purpose of the clinical trial; who can participate, where the trial is located, and contact details.

Medical Disclaimer

This Fact Sheet is intended to provide general information only and, as such, should not be considered as a substitute for advice, medically or otherwise, covering any specific situation. Users should seek appropriate advice before taking or refraining from taking any action in reliance on any information contained in this Fact Sheet. So far as permissible by law, the Cancer Association of South Africa (CANSA) does not accept any liability to any person (or his/her dependants/estate/heirs) relating to the use of any information contained in this Fact Sheet.

Whilst the Cancer Association of South Africa (CANSA) has taken every precaution in compiling this Fact Sheet, neither it, nor any contributor(s) to this Fact Sheet can be held responsible for any action (or the lack thereof) taken by any person or organisation wherever they shall be based, as a result, direct or otherwise, of information contained in, or accessed through, this Fact Sheet.

Sources and References Consulted or Utilised

American Cancer Society
http://www.cancer.org/cancer/eyecancer/detailedguide/eye-cancer-what-is-eye-cancer
http://www.cancer.org/cancer/eyecancer/detailedguide/eye-cancer-diagnosis

Belabbes, S.B. & Belkhadir, K. 2019. Ocular metastasis revealing ductal carcinoma of the breast. *Pan Afr Med J.* 2019 Jan 16;32:29. doi: 10.11604/pamj.2019.32.29.16466. eCollection 2019.

Cancer.Net
http://www.cancer.net/cancer-types/lacrimal-gland-tumor

http://www.cancer.net/cancer-types/eye-cancer/staging-and-grading

Cancer Research UK
http://www.cancerresearchuk.org/cancer-help/type/eye-cancer/about/types-of-eye-cancer
http://www.cancerresearchuk.org/cancer-help/type/eye-cancer/diagnosis/eye-cancer-tests
http://www.cancerresearchuk.org/prod_consump/groups/cr_common/@cah/@gen/documents/generalcontent/living-with-eye-cancer.pdf

Disease.Com
http://cancer.disease.com/Eye/Eye-Cancer-Prognosis.html

Eye 1
http://www.bing.com/images/search?q=free+diagrams+eye&view=detail&id=D971B7324556C9D61B15247852EBA349BAF0B5D1&qpvt=free+diagrams+eye&FORM=IDFRIR

Eye 2
http://www.bing.com/images/search?q=free+diagrams+eye&view=detail&id=A049327B60C75A30BD9D59E56C5112ED221A165A&first=331&FORM=IDFRIR

Free Medical Textbook
http://medtextfree.wordpress.com/2011/01/20/chapter-150-medulloepithelioma/

Galluzzi, P., Casseri, T., Cerase, A., Gguglielmucci, D., Toti, P. & Hadjistiljanou, T. 2018. Conventional, diffusion, and permeability MR findings in ocular medulloepithelioma. *Neuroradiology*. 2018 Nov;60(11):1213-1222. doi: 10.1007/s00234-018-2094-1. Epub 2018 Sep 19.

Gonioscopy Lens
http://www.reviewofoptometry.com/content/d/product_review/c/15438/dnnprintmode/true/?skinsrc=%5Bl%5Dskins/ro2009/pageprint&containersrc=%5Bl%5Dcontainers/ro2009/simple

Indirect Ophthalmoscope
http://howmed.net/ophthalmology/protocol-of-examination-of-indirect-ophthalmoscopy/

Intelihealth.Com
http://www.intelihealth.com/IH/ihtPrint/WSIHW000/9339/10611.html

Johns Hopkins Medicine
http://www.hopkinsmedicine.org/wilmer/conditions/tumors.html

Judd, D.B. & Wyszecki, G. 1975. *Color in Business, Science and Industry*. Wiley Series in Pure and Applied Optics (third ed.). New York: Wiley-Interscience. p. 388. ISBN 0-471-45212-2

Kaliki, S., Vasanthapuram, V.H. & Mishra, D.K. 2019. Conjunctival melanoma in Asian Indians: a study of 42 patients. Semin Ophthalmol. 2019 May 28:1-6. doi: 10.1080/08820538.2019.1620793. [Epub ahead of print]

MacMillan Cancer Support
http://www.macmillan.org.uk/Cancerinformation/Cancertypes/Eye/Melanomaoftheeye.aspx

Mayo Clinic
http://www.mayoclinic.com/print/eye-melanoma/DS00707/METHOD=print&DSECTION=all

MD Anderson Cancer Center
http://www.mdanderson.org/patient-and-cancer-information/cancer-information/cancer-types/eye-cancer/diagnosis/index.html
http://www.mdanderson.org/patient-and-cancer-information/cancer-information/cancer-types/eye-cancer/index.html

Medline Plus
http://www.nlm.nih.gov/medlineplus/eyecancer.html#cat26

Merck Manual
http://www.merckmanuals.com/home/print/eye_disorders/retinal_disorders/cancers_affecting_the_retina.html

National Cancer Institute
http://www.cancer.gov/clinicaltrials/learningabout/what-are-clinical-trials

Ophthalmoscope
https://en.wikipedia.org/wiki/Ophthalmoscopy

Ortiz, M.V. & Dunkel, I.J. 2016. Retinoblastoma. *J Child Neurol.* 2016 Feb;31(2):227-36. doi: 10.1177/0883073815587943. Epub 2015 May 28.

Retinoblastoma Childhood Eye Cancer Trust
http://www.chect.org.uk/cms/index.php/signs-and-symptoms?eprivacy=1

University of Iowa Clinics and Hospitals
http://www.uihealthcare.org/EyeCancer/

Wikipedia
http://en.wikipedia.org/wiki/Human_eye

Zimmer, C. 2012. Our Strange, Important, Subconscious Light Detectors. *Discover Magazine*, Feb.